



# Maternal anemia during pregnancy in Bahirdar Town, Northwestern Ethiopia: A facility-based retrospective study

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## ABSTRACT

**Background:** Anemia during pregnancy is a major public health problem in developing and developed countries. It has been implicated with an increased risk of maternal and fetal morbidity and mortality. Hence, the main objective of this study was to assess the magnitude of maternal anemia during pregnancy at last antenatal care (ANC) visit at Bahirdar Felege-Hiwot referral hospital ANC clinic. **Methods:** An institutional-based retrospective study was conducted in Bahirdar Felege-Hiwot Referral hospital from September 2012 to August 2013. Data were collected from clinical recording charts using data extraction sheet. Both bivariate and multivariate analyses were done to see the association of independent variables with the outcome variable. **Results:** The mean gestational age was 31 weeks (range: 8-43). Of total 1120 pregnant women, 508 (45.4%) of them were anemic. The mean Hemoglobin level of pregnant women was 10.98g/dL ( $\pm 1.68$  standard deviation). Majority (50.4%) of these anemic women were mildly anemic. The remaining 46.5% and 3.1% were moderately and severely anemic. Immunodeficiency virus (HIV) infection was significantly associated with maternal anemia (adjusted odds ratio [95% confidence interval] = 4.78 [3.14, 7.29]). **Conclusion:** The prevalence of anemia was high, and it is a severe public health problem. Mild type anemia was dominant. HIV infection was associated with maternal anemia. Hence, efforts should be made for early diagnosis and management of anemia and HIV.

**KEY WORDS:** Anemia, Ethiopia, pregnancy

## INTRODUCTION

Anemia is one of the most common disorders principally characterized by a decline in the concentration of circulating erythrocytes or hemoglobin (Hgb) in the blood and a concomitant impairment of oxygen transportation that does not meet the body's physiological need [1,2]. The cut-off value to define anemia varies with age, gender, altitude, smoking behavior, and stages of pregnancy [3].

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development [2]. It occurs at all stages of the life cycle but is more prominent in pregnant women, young children and other women of reproductive age [1,4-6]. Globally, anemia affects 1.62 billion

people (24.8%), among which 56 million (41.8%) are pregnant women. It is a major public health problem particularly among poorer segments of the population in developing countries where 95% of the world anemic pregnant women are residing [1,7]. The greatest burden of anemia in pregnant women is found in Asia and Africa content [2]. Of the total anemic pregnant women, about 57.1% have been residing in African countries.

In Ethiopia, it has also been estimated that 62.7% of pregnant women were suffering from anemic; and it is a severe public health problem [1,8]. It is the most frequent morbidity among pregnant women with a wide range of variation in magnitude at different geographical location. Moreover, evidences reveal that there is an urban-rural difference in the prevalence of maternal anemia [9-15]. It is still a public health problem because the nutritional status of women in Ethiopia is low while their

daily workload is often enormous to ensure survival of their children [16]. To reduce the risk of nutritional anemia during pregnancy, some strategic programs were formulated and are being implemented [17].

Anemia during pregnancy is harmful and associated with poor pregnancy outcomes. However, the extent to which maternal anemia affects maternal and neonatal health is still uncertain. There are several studies suggesting the possible associations of maternal anemia with maternal and child or fetus complications. It increases the risk of maternal and neonatal mortality and morbidity, preterm delivery, low birth weight, intrauterine fetal death, cognitive impairment, and lowered immune status of women [18-21]. It also implicates with the development of anemia in children born from anemic women which impairs child growth [22-24].

In developing countries like Ethiopia, the etiology of anemia is multifactorial and complex. It includes nutritional deficiencies, malabsorption, increased destruction of red cells, diminished erythropoiesis, loss of blood, and infectious agents [25,26]. Even though the relative contribution of each factor varies greatly by geographical location, season and dietary practice, nutritional deficiency is by far the most common cause of anemia in sub-Saharan Africa [4]. During pregnancy, women are particularly susceptible to iron deficiency anemia (IDA) because of increased demands of iron for fetal development [27]. Thus, IDA is the most common contributing factor to total disability adjusted life years lost in the developing world [28].

Anemia prevalence data remain an important indicator of public health because it is being related to morbidity and mortality of vulnerable segment of the population such as pregnant women and preschool children [28]. Besides, at a global level, anemia prevalence is a useful indicator to monitor the impact of widespread or highly effective interventions and to track the progress made toward the goal of reducing anemia during pregnancy and maternal mortality [26,29]. Few epidemiological studies on the prevalence of anemia in pregnant women were done in a different part of Ethiopia and reported varying magnitude of the problem [9-15,30]. Because of the variability of factors associated with maternal anemia in different localities, studies have to be conducted in a different part of Ethiopia to understand the comprehensive epidemiology of anemia in Ethiopia. Therefore, the aim of this study was to determine the magnitude of maternal anemia among pregnant women who attended antenatal care (ANC) at Bahirdar Felege-hiwot Referral hospital in Northwest Ethiopia.

## METHODS

This was a retrospective study conducted on pregnant women who registered at Bahirdar Felege-Hiwot Referral hospital ANC clinic, Northwest Ethiopia between September 1, 2012 and August 31, 2013. The hospital is found in Bahirdar city which is located approximately 565 km far from Addis Ababa to the North Western part of Ethiopia. The city is also found at an evaluation of about 1800 m above sea level; and it has an average temperature of 25° centigrade. Felege-Hiwot referral hospital

is a tertiary health institution offering both primary health services and serving as a major referral center for the people of West Gojam district and the surrounding districts of Amhara regional state. It provides services for approximately 5-7 million people annually in Northwest Ethiopia.

All pregnant women who attended ANC between September 1, 2012 and August 31, 2013 were included in the study. The case records of women registered for ANC were taken from ANC clinic, and the data were retrieved from medical record department of the hospital using data extraction sheet. The data obtained were age, residence, Hgb level, gestational age, gravidity, nutritional supplementation at their current pregnancy and human Immunodeficiency virus (HIV) sero-status. The data were collected in March 2014.

To define anemia and classify the degree of severity, Hgb cut-off value after the measured Hgb was adjusted to sea level is used on the basis of gestational age using WHO criteria [30]. The Hgb <11.0g/dL at first and third trimesters and Hgb <10.5 g/dL at second trimester were used to define anemia. The Hgb value of 10g/dL ≤ Hgb <11g/dL at first and third trimesters and 10 g/dL ≤ Hgb < 10.5 g/dL at second trimester were classified as mild anemia. Besides, Hgb value of 7 g/dL ≤ Hgb <10 g/dL and Hgb <7 g/dL were categorized as moderate and severe anemic, respectively, regardless of gestational age [1,30].

The data were checked, sorted, and coded. Then data were entered to EPI info version 3.5.3 and transferred to Statistical Package for the Social Sciences (IBM, LA, US) version 20 for analysis. Description of mean, frequencies, and proportions of the given data for each variable were calculated and summarized in the form of tables and figure. Bivariate analysis was done to see the association of each independent variable with the outcome variable. Those variables having  $P < 0.2$  were entered into the multivariate logistic regression model to identify the effect of each independent variable with the outcome variables. Variables having  $P < 0.05$  in multivariate logistic regression analysis were considered statistically significant, and adjusted odds ratio with 95% confidence interval (CI) was calculated to determine the association.

The study was approved by institutional review board of the University of Gondar. Official supportive letter was also obtained from the diagnostic director and communicated with ANC clinic and medical record department of the Felege-Hiwot Referral hospital before commencement of data collection. All data obtained were kept confidential.

## RESULT

### Socio-demographic Characteristics

A total of 1120 pregnant women were included in the study. About 87.5% (980/1120) of the study participants were living in the urban area. The mean age of the study participants was 26.13 year ( $\pm$  4.55 year standard deviation [SD]). The minimum and maximum age of the study participants were 17 and 45 years, respectively [Table 1].

## Obstetrics and Medical Condition of Study Participants

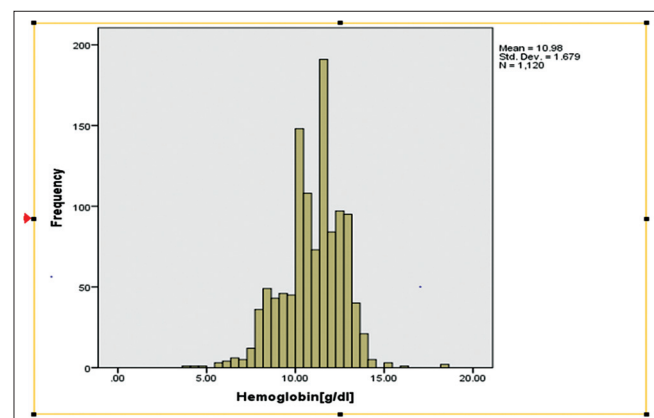
Of the total study participants, 826 (73.80%) and 283 (25.3%) pregnant women had last ANC visit record at their third and second trimester, respectively. The mean gestational age at last ANC visit was 31 week (range: 8-43). Regarding the medical condition, 135 (12.1%) of them were HIV sero-reactive. About 28 (2.5%) were hypertensive; of whom 7 (60.7%) were diastolic only, 8 (25.6%) were systolic only, and 3 (10.7) were both diastolic and systolic hypertensive. Almost all, 1118 (99.8%) study participants had taken nutritional supplements in their current pregnancy. The majority, 366 (32.7%) of the pregnant women attended ANC service at Felege-Hiwot Referral hospital once in their current pregnancy [Table 2].

## PREVALENCE OF ANEMIA

The mean Hgb level of pregnant women was 10.98g/dL ( $\pm 1.68$ g/dL SD). The minimum and Hgb value of the study participant were 4.0 g/dL and 18.5 g/dL, respectively [Figure 1]. The overall prevalence of maternal anemia was 508 (45.4%). Out of the total anemic pregnant women, 256 (50.4%), 236 (46.5%), and 16 (3.1%) of them were mildly, moderately, and severely anemic, respectively [Figure 2].

High prevalence of anemia was observed in those pregnant women who were within the age of 31-35 years (53.1%) and who were rural residents (50.7%) [Table 3].

The prevalence of maternal anemia was assessed by taking obstetrical and medical conditions of pregnant women into a consideration. High prevalence of anemia was found among pregnant women who were being infected with HIV (77.0%), who visited ANC four times (50.5%) and who were at second trimester during their last ANC visit (48.4%). About 506 (45.3%) of pregnant women who took Nutritional supplementation during their current pregnancy were anemic. HIV infection was found to be statistically significant factor for a high prevalence of anemia among pregnant women. Pregnant women who were being infected with HIV had almost five times more likelihood of being anemic when compared to those pregnant women who



**Figure 1:** The hemoglobin value distribution of pregnant women who attended antenatal care service at Bahirdar Felege-Hiwot Referral hospital from September 2012 to August 2013

**Table 1:** Selected sociodemographic characteristics of pregnant women who attended ANC service at Bahirdar Felege-Hiwot Referral Hospital from September 2012 to August 2013

Variables	Frequency	Percentage
Age		
<20	138	12.3
20-25	419	37.4
26-30	428	38.2
31-35	96	8.6
>35	39	3.5
Residence		
Urban	980	87.5
Rural	140	12.5

**Table 2:** Obstetrical and medical characteristics of pregnant mothers at their last ANC service at Bahirdar Felege-Hiwot Referral Hospital from September 2012 to August 2013

Variables	Frequency	Percentage
Gestational age		
1 <sup>st</sup> trimester (up to 13 weeks)	11	1
2 <sup>nd</sup> trimester (14 week-26 weeks)	283	25.2
3 <sup>rd</sup> trimester (after 26 weeks)	826	73.8
Gravidity		
Primigravidae	610	54.5
Secundigravidae	191	17
3 gravida	254	22.7
≥4 gravida	65	5.8
HIV sero-reactivity		
Reactive	135	12.1
Non-reactive	985	87.9
Hypertension		
Yes	28	2.5
No	1092	97.5
Type of hypertension		
Systolic hypertensive only	8	25.6
Diastolic hypertensive only	17	60.7
Both systolic and diastolic hypertensive	3	10.7
Nutritional supplementation		
Yes	1118	99.8
No	2	0.2
ANC visit		
Visited once	366	32.7
Visited twice	276	24.6
Visited 3 times	264	23.6
Visited ≥4 times	214	19.1

ANC: Antenatal care

**Table 3:** Prevalence of maternal anemia according to selected sociodemographic characteristics of pregnant women who attended ANC service at Bahirdar Felege-Hiwot Referral Hospital from September 2012 to August 2013

Variable	Anemic status (n (%))		Total (%)	COR (95%CI)
	Anemic	Non-anemic		
Age				
<20	62 (44.9)	76 (55.1)	138 (12.3)	1
21-25	190 (45.3)	229 (54.7)	419 (37.4)	1.02 (0.69,1.50)
26-30	186 (43.5)	242 (56.5)	428 (38.2)	0.94 (0.64,1.39)
31-35	51 (53.1)	45 (46.9)	96 (8.6)	1.39 (0.82, 2.34)
>35	19 (48.7)	20 (51.3)	39 (3.5)	1.16 (0.57, 2.38)
Residence				
Urban	437 (44.6)	543 (55.4)	980 (87.5)	1
Rural	71 (50.70)	69 (49.30)	140 (12.5)	1.28 (0.87,1.76)

ANC: Antenatal care

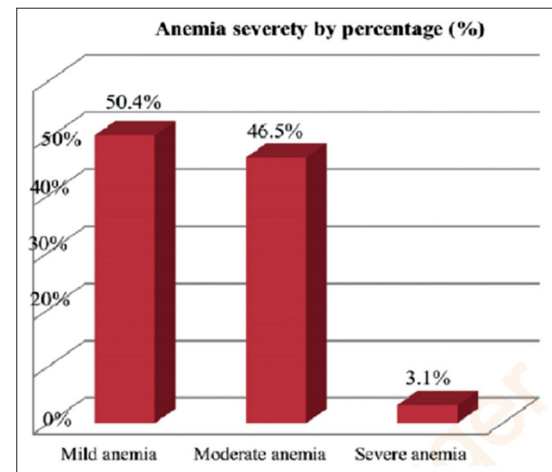
were HIV sero-negative (adjusted odds ratio [95%CI] = 4.78 [3.14, 7.29]). ANC visit was significantly associated with anemia in bivariate analysis. But when adjusted for confounding factors in multivariate analysis, it had not significant association. The reason might be due the fact that the distribution of anemia is comparable across all categories ranging from 44% to 50.5%. Moreover, in developing countries like Ethiopia, the habit of ANC attendance is low unless they are symptomatically ill [Table 4].

## DISCUSSION

The overall prevalence of anemia in this study population using a cut-off level of Hb <11 g/dl was 45.5% (508/1120). This is considerably comparable to studies conducted in Southeastern Nigeria (40.4%) [31]. The result of this study is also in agreement with 2008 WHO's report in which 41.8% of pregnant women were suffering from anemia [26].

The prevalence of anemia was higher than similar studies conducted in Trinidad and Tobago (15.3%) [26], Southwest Nigeria (30%) [32], West Arsi zone, Ethiopia (36.6%) [15], Southeast Ethiopia (27.9%) [12], Addis Ababa, Ethiopia (21.3%) [13], Azezo health center, Ethiopia (21.1%) [10] and Gondar town (16.6%) [9]. The possible reasons for this disparity might be attributed to the geographical variation of factors across different areas like infectious diseases, difference in socio-economic status and the time gap between the current study and the above studies.

However, the prevalence of anemia in the current study is lower than similar studies conducted in Burkina Faso (66%) [33], Rivers state, Nigeria (62.6%) [34] and Pakistan (56.1%) [35]. High prevalence of anemia in western African countries and Pakistan might be due the burden of hemoglobinopathies [36-38]. Likewise, the prevalence of anemia in the current study is lower than the study conducted in Eastern Ethiopia (56.8%) [30] and Gilgel gibe, South Western Ethiopia (53.9%) [14]. The difference might be due to the fact that Eastern and South Western Ethiopia are malaria epidemic areas which may



**Figure 2:** Severity of anemia among anemic pregnant women who attended antenatal care service at Bahirdar Felege-Hiwot Referral Hospital from September 2012 to August 2013 ( $n = 508$ )

**Table 4:** The prevalence of maternal anemia according to the obstetrics and medical characteristics and nutritional supplementation among pregnant women who attended ANC service at Bahirdar Felege-Hiwot Referral Hospital from September 2012 to August 2013

Variables	Anemic status (%)			COR (95%CI)	AOR (95%CI)
	Anemic	Non-anemic	Total		
HIV					
Sero-positive	104 (77.0)	31 (23.0)	135 (12.0)	4.83 (3.16,7.35)*	4.78 (3.14, 7.29)*
Sero-negative	404 (41.0)	581 (59.0)	985 (87.9)	1	
Gestation age					
1 <sup>st</sup> trimester	5 (45.5)	6 (54.5)	11 (0.98)	1	
2 <sup>nd</sup> trimester	137 (48.4)	146 (51.5)	283 (25.2)	1.04 (0.32,346)	
3 <sup>rd</sup> trimester	366 (44.3)	460 (55.7)	826 (73.8)	1.18 (0.90,1.5)	
Gravidity					
Primigravidae	282 (46.2)	328 (53.8)	610 (54.5)	1	
Secundigravidae	81 (42.4)	110 (57.6)	191 (17)	0.87 (0.62, 1.19)	
3 gravida	116 (45.7)	138 (54.3)	254 (22.7)	0.98 (0.73, 1.31)	
≥4 gravida	29 (44.6)	36 (55.4)	65 (5.8)	0.94 (0.56, 1.57)	
Hypertension					
Hypertensive	12 (42.9)	16 (57.1)	28 (2.5)	0.90 (0.42,1.92)	
Non-hypertensive	496 (45.4)	596 (54.6)	1092 (97.5)	1	
ANC follow-up					
Visited once	161 (44.0)	205 (56.0)	366 (32.7)	0.77 (0.55,1.08)	0.92 (0.65, 1.31)
Visited twice	130 (47.1)	146 (52.9)	276 (24.6)	0.87 (0.61,1.25)	0.94 (0.65, 1.36)
Visited 3 times	109 (41.3)	155 (58.7)	264 (23.6)	0.69 (0.48,0.99)	0.73 (0.5, 1.10)
Visited >4 times	108 (50.5)	106 (49.5)	214 (19.1)	1	
Nutritional supplementation					
Yes	506 (45.3)	612 (54.7)	1118 (98.8)		
No	2 (100)	0	2 (0.2)		

Bold numerical value indicates statistically significant in bivariate but not in multivariate analysis. \*significant at  $P < 0.001$  in both bivariate and multivariate analysis, ANC: Antenatal Care, AOR: Adjusted odds ratio, CI: Confidence interval



contribute for the increasing magnitude of anemia among pregnant women.

In our study, residence and age were not significantly associated with maternal anemia. This is in agreement with studies done in Rivers state Nigeria [34], Gondar, Ethiopia [9], Eastern Ethiopia [30] and Southeast Ethiopia [12]. However, it is in contrast to the studies conducted at Azezo health center, Ethiopia [10] and Gilgel gibe, Ethiopia [14] in which residential area of the pregnant women and age were statistically associated with maternal anemia. The possible reasons for the difference may be explained that in our study majority of pregnant women were from urban setting area whereas in Azezo and Gilgel gibe studies urban and rural residence proportion of the study participants was not much exaggerated.

In our study, the predominant type of anemia was mild type (50.4%) followed by moderate type (46.5%). This finding is in line with studies conducted in South Eastern Nigeria [31], Southeast Ethiopia [12], Addis Ababa, Ethiopia [13], Gilgel gibe [14], Gondar town, Ethiopia [9] and Azezo health center [10]. However, it contradicts with studies conducted in Burkina Faso [33] and teaching hospital in Southwestern Nigeria [39] in which moderate type was predominant followed by mild type. This variation might be attributed to the difference in socio-demographic and lifestyle between study participants. It might also be the result of differences in policies and strategies placed to reduce maternal mortality and morbidity across these countries.

In the current study, pregnant women who had been HIV sero-positive were five times more likely to be anemic compared with HIV sero-negative pregnant women. This is consistent with studies conducted in Southeastern Nigeria, Southwestern Nigeria, Burkina Faso, Gondar town, Ethiopia [9,31-33]. The possible reason might be due to the deregulation of host immune system leading to destruction and/or inhibition of hematopoietic cells and under-regulated utilization of serum micronutrients during HIV infection [9].

In the current study, the prevalence of anemia among pregnant women was high. According to WHO classification of the public health importance of anemia [3], it is a severe public health problem. The predominant type of anemia was mild type followed by moderate anemia. HIV infection was significantly associated with maternal anemia. There is a need to design strategies and program that promote mothers to be screened for HIV before getting pregnancy. Pregnant women should also be encouraged to have early and regular ANC follow-up for early diagnosis and management of HIV infection and other health-related problems. Furthermore, since the current study was institutional-based retrospective study, further in-depth community-based studies should have to be conducted to investigate determinants of maternal anemia during pregnancy.

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